

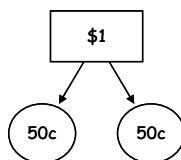
## Dividing Fractions and Mixed Numbers - Green Problems

What does dividing 6 by  $\frac{1}{2}$  tell us? It tells us how many  $\frac{1}{2}$ 's there are in 6.

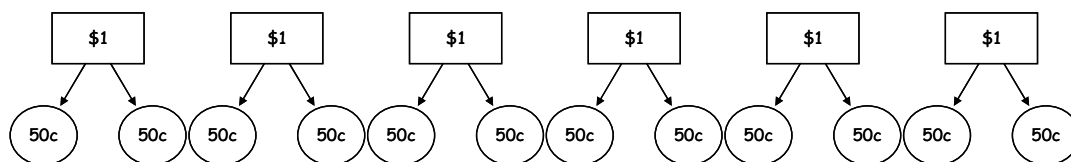
So, what does  $6 \div \frac{1}{2}$  equal?

Suppose we are talking about money. Dividing 6 by  $\frac{1}{2}$  would tell us how many half-dollars there are in six dollars.

*In \$1 there are 2 half-dollars.*



*So, in \$6*



*....we can see there are 12 half of dollars.*

By looking at the problem applied to money, we see that  $6 \div \frac{1}{2} = 12$ ,

which is the same answer we get when we multiply  $6 \bullet \frac{2}{1}$ . In other words, dividing by  $\frac{1}{2}$  gives the same answer as multiplying by  $\frac{2}{1}$ .

$$6 \div \frac{1}{2} = 6 \bullet \frac{2}{1}$$

Notice we changed the operation from division to multiplication and changed the divisor to its reciprocal. We use this observation to write the rule for dividing fractions.

### To Divide By a Fraction

Change division to multiplication by the reciprocal of the divisor. Then multiply.

Recall that the *divisor* is the number that is being divided by, and the *reciprocal* of a fraction is found by switching the numerator and the denominator of the fraction.

<b>Example 1</b>	Evaluate	$\frac{6}{1} \div \frac{1}{2}$	
<i>Solution:</i>		$\frac{6}{1} \div \frac{1}{2} = \frac{6}{1} \bullet \frac{2}{1}$ $= \frac{12}{1}$ $= 12$	<p><i>Change division to multiplication by the reciprocal of the divisor.</i></p>
<b>Example 2</b>	Evaluate	$\frac{2}{3} \div 6$	
<i>Solution:</i>		$\frac{2}{3} \div 6 = \frac{2}{3} \div \frac{6}{1}$ $= \frac{2}{3} \bullet \frac{1}{6}$ $= \frac{2}{18}$ $= \frac{1}{9}$	<p><i>Write 6 as a fraction</i></p> <p><i>Change division to multiplication by the reciprocal of the divisor.</i></p>
<b>Example 3</b>	Evaluate	$\frac{1}{\frac{2}{3} \div \frac{5}{6}}$	
<i>Solution:</i>		$\frac{1}{\frac{2}{3} \div \frac{5}{6}} = \frac{1}{\frac{2}{3} \div \frac{5}{6}}$ $= \frac{1}{\frac{2}{3} \bullet \frac{6}{5}}$ $= \frac{5}{6}$	<p><i>The fraction bar indicates division.</i></p> <p><i>Change division to multiplication by the reciprocal of the divisor</i></p>
<b>Example 4</b>	Evaluate	$4\frac{2}{5} \div 3\frac{2}{3}$	
<i>Solution:</i>		$4\frac{2}{5} \div 3\frac{2}{3} = \frac{22}{5} \div \frac{11}{3}$ $= \frac{22}{5} \bullet \frac{3}{11}$ $= \frac{66}{55}$ $= \frac{6}{5}$ $= 1\frac{1}{5}$	<p><i>Convert the mixed numbers to improper fractions.</i></p> <p><i>Change division to multiplication by the reciprocal of the divisor.</i></p>

## Exercise Set

1. What does dividing 6 by  $\frac{1}{2}$  mean?
2. Explain why the answer to *Example 1* makes sense?
3. What is the rule for division by a fraction?
4. What is the reciprocal of a fraction?
5. Explain how you would divide a fraction by a whole number. (see *Example 2*)
6. a. Draw a diagram showing  $\frac{3}{4} \div 2$       b. Evaluate  $\frac{3}{4} \div 2$
7. a. Draw a diagram showing  $4 \div \frac{1}{2}$       b. Evaluate  $4 \div \frac{1}{2}$
8. Evaluate.
  - a.  $\frac{3}{5} \div \frac{7}{2}$
  - b.  $\frac{2}{3} \div \frac{7}{5}$
  - c.  $\frac{2}{7} \div \frac{5}{9}$
  - d.  $\frac{1}{2} \div \frac{2}{3}$
  - e.  $\frac{1}{2} \div \frac{2}{5}$
  - f.  $\frac{2}{3} \div \frac{1}{6}$
  - g.  $\frac{1}{2} \div 2\frac{1}{4}$
  - h.  $1\frac{5}{6} \div 2$
9. Evaluate.
  - a.  $1\frac{1}{2} \div \frac{1}{4}$
  - b.  $\frac{2}{3} \div 2\frac{1}{3}$
  - c.  $\frac{1}{2} \div \frac{1}{4}$
  - d.  $3 \div 2\frac{2}{3}$
  - e.  $\frac{6}{\frac{1}{2}}$
  - f.  $\frac{3\frac{1}{3}}{5}$
  - g.  $\frac{\frac{7}{8}}{\frac{3}{16}}$
  - h.  $\frac{1\frac{3}{5}}{\frac{1}{2}}$
10. a. How many fourths are in  $\frac{1}{2}$ ? Write the division problem and solve it.  
b. How many tenths are in  $\frac{3}{5}$ ? Write the division problem and solve it.
11. The cafeteria has baked 17 pizzas for lunch. Each person gets  $\frac{1}{4}$  of a pizza for his/her serving. How many servings will the pizzas make?
12. You and a friend have gone out for pizza and are trying to split up the left-overs evenly. There is  $\frac{3}{4}$  of a pizza left. How much pizza do you and your friend each get

to take home? Draw a picture to show your answer is correct.

13. Antonio is baking bread but does not have a bowl large enough for the amount of dough he wants. He is going to divide the recipe into 3 bowls. Determine how much of each ingredient should go into each bowl.

$8\frac{1}{2}$  cups flour

$1\frac{1}{2}$  tablespoons salt

4 tablespoons dry yeast

$2\frac{1}{4}$  cups warm water

$\frac{1}{2}$  cup oil

14. Pedro has borrowed Antonio's bread recipe, but the only measuring cup he has is a  $\frac{1}{2}$  cup measure. Determine how many times he will have to fill it up to measure the following ingredients.

a.  $8\frac{1}{2}$  cups flour

b.  $\frac{1}{2}$  cup oil

c.  $2\frac{1}{4}$  cups warm water

15. Selena is helping Pedro with the bread but she has only a  $\frac{3}{4}$  tablespoon measuring spoon. How many spoonfuls will she need to measure each of the following?

a.  $1\frac{1}{2}$  tablespoons salt

b. 6 tablespoons sugar

c. 4 tablespoons dry yeast

16. Mei-Ling is building a bookcase. She has a 12-foot long board which she needs to cut into shelves that measure  $2\frac{1}{4}$  feet long. How many shelves can she make out of the board?

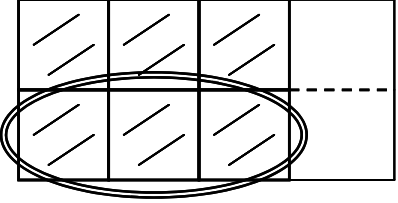
17. Dontaye wants to put six new speakers into his car. It takes at least  $3\frac{1}{2}$  feet of speaker wire to connect each speaker to his car stereo. He has 20 feet of speaker wire. Can he hook up all 6 speakers? Explain your answer.

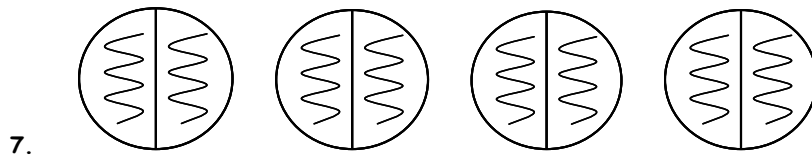
#### Dividing Fractions and Mixed Numbers – Green Solutions

##### Exercise Set

- Dividing 6 by  $\frac{1}{2}$  means finding out the number of times that  $\frac{1}{2}$  goes into 6. There are 12 halves in 6. Therefore, 6 divided by  $\frac{1}{2} = 12$ .
- Because dividing by  $\frac{1}{2}$  is the same as multiplying by the reciprocal of  $\frac{1}{2}$ , which is 2. Therefore, dividing a value by  $\frac{1}{2}$  is the same as doubling the value.

3. Change division to multiplication. Instead of dividing by a fraction, multiply by the fraction's reciprocal.
4. A reciprocal is found by switching the numerator and the denominator of the fraction.
5. First, write 6 as a fraction. Then, multiply  $\frac{2}{3}$  by the reciprocal of 6, which is  $\frac{1}{6}$ .

6.   $\frac{3}{4} \div 2$

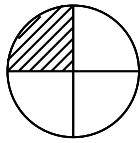
$$\frac{3}{4} \cdot \frac{1}{2} = \frac{3}{8}$$


$4 \div \frac{1}{2}$  means, "how many halves are in 4 wholes?"

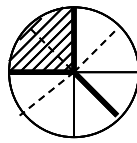
There are 8 halves in 4 wholes.

$$4 \div \frac{1}{2} = \frac{4}{1} \cdot \frac{2}{1} = \frac{8}{1} = 8$$

8. a.  $\frac{6}{35}$     b.  $\frac{10}{21}$     c.  $\frac{18}{35}$     d.  $\frac{3}{4}$   
       e.  $\frac{5}{4}$     f. 4    g.  $\frac{4}{18}$     h.  $\frac{11}{12}$
9. a. 6    b.  $\frac{2}{7}$     c. 2    d.  $\frac{9}{8}$   
       e. 12    f.  $\frac{2}{3}$     g.  $\frac{14}{3}$     h.  $\frac{16}{5}$
10. a.  $\frac{1}{2} \div \frac{1}{4} = 2$     b.  $\frac{3}{5} \div \frac{1}{10} = 6$
11. 68 servings
12.  $\frac{3}{4} \cdot \frac{1}{2} = \frac{3}{8}$



$\frac{3}{4}$  leftover (unshaded)



Divide the leftover portion in half leaves you and your friend with  $\frac{3}{8}$  of a pizza each.

13.  $2\frac{5}{6}$  cups of flour  $\frac{1}{2}$  tablespoon of salt

$1\frac{1}{3}$  tablespoon dry yeast  $\frac{3}{4}$  cup of warm water

$\frac{1}{6}$  cup of oil

14. a. 17 times b. 1 time c.  $4\frac{1}{2}$  times

15. a. 2 spoonfuls b. 8 spoonfuls c.  $5\frac{1}{3}$  spoonfuls

16. 5 whole shelves plus  $\frac{1}{3}$  of another shelf (which is useless, but could possibly be used for something else).

17. No.  $3\frac{1}{2} \cdot 6 = 21$  feet of wire that's needed to hook up all 6 speakers. He only has 20 feet of wire.